



BUREAU
VERITAS

Certificate of compliance

Applicant: NingBo Deye Inverter Technology Co., Ltd.
No. 26 South YongJiang Road Daqi, Beilun, NingBo,
China

Product: Photovoltaic inverter

Model: SUN-120K-G01P3-EU-AM8,
SUN-125K-G01P3-EU-AM8,
SUN-130K-G01P3-EU-AM8,
SUN-135K-G01P3-EU-AM8,
SUN-136K-G01P3-EU-AM8

Use in accordance with regulations:

Automatic disconnection device with three-phase mains surveillance in accordance with Engineering Recommendation G99/NI for photovoltaic systems with a three-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter. This serves as a replacement for the disconnection device with isolating function, which can be accessed the distribution network provider at any time.

Applied rules and standards:

Engineering Recommendation G99/1-10:2024

Requirements for the connection of generation equipment in parallel with public distribution networks in Northern Ireland

At the time of issue of this certificate, the safety concept of an aforementioned representative product corresponds to the valid safety specifications for the specified use in accordance with regulations.

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Certification body

Accreditation



Domenik Koll
Head of Energy Systems Germany



Accredited certification body by Deutsche Akkreditierungsstelle GmbH (DAkkS) according to ISO/IEC 17065. The accreditation is valid only for the scope listed in the annex of the accreditation certificate D-ZE-12024-01-00. The Deutsche Akkreditierungsstelle GmbH (DAkkS) is signatory of the multilateral arrangements of EA, ILAC and IAF for mutual recognition.

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Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/N1

Type Approval and declaration of compliance with the requirements of Engineering Recommendation G99/N1.

PGM Technology	Photovoltaic inverter			
Manufacturer	NingBo Deye Inverter Technology Co., Ltd.			
Address	No. 26 South YongJiang Road, Daqi, Beilun, NingBo, China			
Tel	+852 2884 4318	Fax	--	
Email	zhaoxt@deye.com.cn	Website	--	
Model	SUN-120K-G01P3-EU-AM8	SUN-125K-G01P3-EU-AM8	SUN-130K-G01P3-EU-AM8	SUN-135K-G01P3-EU-AM8
Input (DC photovoltaic)				
MPP voltage range [V]	200-1000	200-1000	200-1000	200-1000
Max. input voltage [V]	1100	1100	1100	1100
Max. input current per MPPT [A]	8*40	8*40	8*40	8*40
Output (AC)				
Rated AC voltage [V]	3L/N/PE, 230/400V, 50Hz	3L/N/PE, 230/400V, 50Hz	3L/N/PE, 230/400V, 50Hz	3L/N/PE, 230/400V, 50Hz
Rated output current [A]	174,0	181,2	188,5	195,7
Max. output current [A]	191,4	195,7	195,7	195,7
Nom. converter output (P _{NINV}) [kW]	120,0	125,0	130,0	135,0
Max. apparent power [kVA]	132,0	135,0	135,0	135,0
Model	SUN-136K-G01P3-EU-AM8	--	--	--
Input (DC photovoltaic)				
MPP voltage range [V]	200-1000	--	--	--
Max. input voltage [V]	1100	--	--	--
Max. input current per MPPT [A]	8*40	--	--	--
Output (AC)				
Rated AC voltage [V]	3L/N/PE, 230/400V, 50Hz	--	--	--
Rated output current [A]	197,2	--	--	--
Max. output current [A]	197,2	--	--	--
Nom. converter output (P _{NINV}) [kW]	136,0	--	--	--
Max. apparent power [kVA]	136,0	--	--	--

Interface protection system and interface switch (Network and system protection “NS-protection”)	
Type of protection	integrated NS-protection
Assigned to generation unit type	SUN-120K-G01P3-EU-AM8, SUN-125K-G01P3-EU-AM8, SUN-130K-G01P3-EU-AM8, SUN-135K-G01P3-EU-AM8, SUN-136K-G01P3-EU-AM8
Integrated interface switch	Type of switching equipment 1: Relay (Model CHAR-112A200C) Type of switching equipment 2: Relay (Model CHAR-112A200C)
	Note: The output is switched off by the inverter bridge and two relay in series in each line and neutral.
Software	
Firmware version	5531-0115
Differences between Generating Units	
The models SUN-120K-G01P3-EU-AM8, SUN-125K-G01P3-EU-AM8, SUN-130K-G01P3-EU-AM8, SUN-135K-G01P3-EU-AM8, and SUN-136K-G01P3-EU-AM8 are based on the same hardware platform, use the same control unit and software.	
The above stated Generating Units are tested according the requirements in the Engineering Recommendation G99/N1. Any modification that affects the stated tests must be named by the manufacturer/supplier of the product to ensure that the product meets all requirements of the Engineering Recommendation G99/N1.	

Operating Range.	
Test 1	Voltage = 85% of nominal (195,5 V) Frequency = 47,5 Hz Power Factor = 1 Period of test 20 seconds
Connection	Always connected
Limit	Always connected
Test 2	Voltage = 85% of nominal (195,5 V) Frequency = 47,5 Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit	Always connected
Test 3	Voltage = 110% of nominal (253 V) Frequency = 51,5 Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit	Always connected
Test 4	Voltage = 110% of nominal (253,0 V) Frequency = 52,0 Hz Power Factor = 1 Period of test 15 minutes
Connection:	Always connected
Limit	Always connected
Test 5	Voltage = 100% of nominal (230,0 V) Frequency = 50,0 Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit	Always connected
Test 6	Confirm that the Power Generating Module is capable of staying connected to the Distribution Network and operate at rates of change of frequency up to 1 Hzs ⁻¹ as measured over a period of 500 ms. Note that this is not expected to be demonstrated on site.
Connection:	Always connected
Limit	Always connected

Protection. Voltage tests.						
Phase 1						
Function	Setting		Trip test		No trip test	
	Voltage [V]	Time delay [s]	Voltage [V]	Time delay [s]	Voltage / time	Confirm no trip
U/V stage	184,0	2,5	183,9	2,525	188V / 5,0s	No trip
					180V / 2,45s	No trip
O/V stage 1	262,2	1,0	262,1	1,083	258,2V 5,0s	No trip
O/V stage 2	273,7	0,5	273,6	0,526	269,7 V / 0,95s	No trip
					277,7V 0,45s	No trip
Note. For Voltage tests the Voltage required to trip is the setting $\pm 3,45V$. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting $\pm 4V$ and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

Protection. Voltage tests.						
Phase 2						
Function	Setting		Trip test		No trip test	
	Voltage [V]	Time delay [s]	Voltage [V]	Time delay [s]	Voltage / time	Confirm no trip
U/V stage	184,0	2,5	183,8	2,525	188V / 5,0s	No trip
					180V / 2,45s	No trip
O/V stage 1	262,2	1,0	262,1	1,026	258,2V 5,0s	No trip
O/V stage 2	273,7	0,5	273,7	0,504	269,7 V / 0,95s	No trip
					277,7V 0,45s	No trip

Protection. Voltage tests.						
Phase 3						
Function	Setting		Trip test		No trip test	
	Voltage [V]	Time delay [s]	Voltage [V]	Time delay [s]	Voltage / time	Confirm no trip
U/V stage	184,0	2,5	183,9	2,554	188V / 5,0s	No trip
					180V / 2,45s	No trip
O/V stage 1	262,2	1,0	262,1	1,057	258,2V 5,0s	No trip
O/V stage 2	273,7	0,5	273,6	0,517	269,7 V / 0,95s	No trip
					277,7V 0,45s	No trip
Note. For Voltage tests the Voltage required to trip is the setting $\pm 3,45V$. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting $\pm 4V$ and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

Protection. Frequency tests.						
Function	Setting		Trip test		No trip test	
	Frequency [Hz]	Time delay [s]	Frequency [Hz]	Time delay [s]	Frequency / time	Confirm no trip
U/F stage 1	47,5	20,0	47,50	20,018	47,7 Hz / 30,00 s	No trip
U/F stage 2	47,0	0,5	47,00	0,505	47,2 Hz / 19,50 s	No trip
					46,8Hz / 0,45s	No trip
O/F stage	52,0	0,5	52,00	0,515	51,8 Hz / 120,00 s	No trip
					52,2Hz / 0,45s	No trip
Note. For Frequency Trip tests the Frequency required to trip is the setting $\pm 0,1Hz$. In order to measure the time delay a larger deviation than the minimum required to operate the projection can be used. The "No-trip tests" need to be carried out at the setting $\pm 0,2Hz$ and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

Protection. Loss of Mains.

Inverters tested according to BS EN 62116.

Balancing load on islanded network	33% of -5% Q Test 22	66% of -5% Q Test 12	100% of -5% P Test 5	33% of +5% Q Test 31	66% of +5% Q Test 21	100% of +5% P Test 10
Trip time. Ph1 fuse removed [s]	0,229	0,286	0,420	0,189	0,269	0,406

Note. Trip time limit is 0,5s.

Protection. Re-connection timer.

Test should prove that the reconnection sequence starts in no less than 20 seconds for restoration of voltage and frequency to within the stage 1 settings of table 10.1.

Over Voltage				
Time delay setting		Measured delay		
20s		38,2		
Under Voltage				
Time delay setting		Measured delay		
20s		42,8		
Over Frequency				
Time delay setting		Measured delay		
20s		35,0		
Under Frequency				
Time delay setting		Measured delay		
20s		43,2		
	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.			
	At 257,0V	At 191,5V	At 47,9Hz	At 52,1Hz
Confirmation that the Generating Unit does not re-connect.	No reconnection	No reconnection	No reconnection	No reconnection

Protection. Frequency change, Stability test.

	Start Frequency [Hz]	Change	Test Duration	Confirm no trip
Positive Vector Shift	49,5	+50 degrees		No trip
Negative Vector Shift	50,5	-50 degrees		No trip
Positive Frequency drift	49,0 to 51,0	+0,95Hz/sec	2,1s	No trip
Negative Frequency drift	51,0 to 49,0	-0,95Hz/sec	2,1s	No trip

Limited Frequency Sensitive Mode – Over Frequency							
1-min mean value [Hz]:	a) 50,00	b) 50,25	c) 50,70	d) 51,15	e) 50,70	f) 50,25	g) 50,00
1. Measurement a) to g): Active power output > 80% P_n							
Frequency [Hz]	50,00	50,45	50,70	51,15	50,70	50,45	50,00
P _{expected} [kW]	136,0	134,6	127,8	115,6	127,8	134,6	136,0
P _{measured} [kW]	135,95	134,58	127,78	115,61	127,79	134,64	136,02
2. Measurement a) to g): Active power output 40% and 60% P_n							
Frequency [Hz]	50,00	50,45	50,70	51,15	50,70	50,45	50,00
P _{expected} [kW]	68,00	66,64	59,84	47,60	59,84	66,64	136,00
P _{measured} [kW]	68,01	66,64	59,84	47,60	59,83	66,63	136,00

Output Power with falling Frequency						
Frequency setpoint [Hz]	50,00	49,50	49,00	48,00	47,60	47,10
Frequency [Hz]	50,00	49,50	49,00	48,00	47,60	47,10
Active power [kW]	135,8	135,9	135,9	135,9	135,9	136,0
ΔP/P _{max} [%]		-0,07	-0,07	-0,07	-0,07	0,00
Note. For a CHP the test point a) at 50,00Hz is taken as Registered capacity (P_{max}) due to limited discrete operating points of the CHP's thermal process. No Power reduction take place for electronic inverter						

Power Quality. Harmonics.						
Phase 1						
Generating Unit rating per phase (rpp)			SUN-136K-G01P3-EU-AM8			
	At 45-55% of rated ouput 68,0 kW		100% of rated output 136,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,066	0,033	0,134	0,068	8%	8%
3rd	0,019	0,010	0,028	0,014	21,6%	N/A
4th	0,056	0,028	0,126	0,064	4%	4%
5th	0,069	0,035	0,083	0,042	10,7%	10,7%
6th	0,005	0,003	0,008	0,004	2,67%	2,67%
7th	0,049	0,025	0,055	0,028	7,2%	7,2%
8th	0,031	0,016	0,044	0,023	2%	2%
9th	0,016	0,008	0,027	0,014	3,8%	N/A
10th	0,027	0,013	0,049	0,025	1,6%	1,6%
11th	0,198	0,101	0,447	0,227	3,1%	3,1%
12th	0,003	0,002	0,005	0,002	1,33%	1,33%
13th	0,138	0,070	0,331	0,168	2%	2%
14th	0,023	0,012	0,040	0,020	N/A	N/A
15th	0,004	0,002	0,009	0,004	N/A	N/A
16th	0,020	0,010	0,031	0,016	N/A	N/A
17th	0,066	0,033	0,152	0,077	N/A	N/A
18th	0,003	0,001	0,004	0,002	N/A	N/A
19th	0,043	0,022	0,121	0,061	N/A	N/A
20th	0,013	0,007	0,023	0,012	N/A	N/A
21th	0,004	0,002	0,006	0,003	N/A	N/A
22th	0,012	0,006	0,023	0,012	N/A	N/A
23th	0,014	0,007	0,064	0,033	N/A	N/A
24th	0,002	0,001	0,002	0,001	N/A	N/A
25th	0,006	0,003	0,051	0,026	N/A	N/A
26th	0,006	0,003	0,017	0,008	N/A	N/A
27th	0,003	0,002	0,005	0,002	N/A	N/A
28th	0,004	0,002	0,015	0,007	N/A	N/A
29th	0,005	0,003	0,030	0,015	N/A	N/A
30th	0,002	0,001	0,002	0,001	N/A	N/A
31th	0,009	0,005	0,024	0,012	N/A	N/A
32th	0,002	0,001	0,011	0,006	N/A	N/A
33th	0,003	0,001	0,004	0,002	N/A	N/A
34th	0,004	0,002	0,011	0,006	N/A	N/A
35th	0,012	0,006	0,013	0,007	N/A	N/A
36th	0,002	0,001	0,002	0,001	N/A	N/A
37th	0,010	0,005	0,018	0,009	N/A	N/A
38th	0,003	0,001	0,010	0,005	N/A	N/A
39th	0,003	0,001	0,003	0,002	N/A	N/A
40th	0,005	0,003	0,010	0,005	N/A	N/A
THD ₄₀ [%]	-	0,293	-	0,326	23%	13%
PWHD [%]	-	0,198	-	0,504	23%	22%

Power Quality. Harmonics.						
Phase 2						
Generating Unit rating per phase (rpp)			SUN-136K-G01P3-EU-AM8			
	At 45-55% of rated ouput 68,0 kW		100% of rated output 136,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,069	0,035	0,168	0,085	8%	8%
3rd	0,009	0,004	0,042	0,021	21,6%	N/A
4th	0,057	0,029	0,129	0,065	4%	4%
5th	0,071	0,036	0,089	0,045	10,7%	10,7%
6th	0,009	0,005	0,014	0,007	2,67%	2,67%
7th	0,055	0,028	0,079	0,040	7,2%	7,2%
8th	0,018	0,009	0,030	0,015	2%	2%
9th	0,009	0,005	0,016	0,008	3,8%	N/A
10th	0,031	0,016	0,054	0,027	1,6%	1,6%
11th	0,199	0,101	0,449	0,228	3,1%	3,1%
12th	0,006	0,003	0,011	0,006	1,33%	1,33%
13th	0,138	0,070	0,327	0,166	2%	2%
14th	0,023	0,012	0,045	0,023	N/A	N/A
15th	0,005	0,002	0,008	0,004	N/A	N/A
16th	0,019	0,009	0,031	0,016	N/A	N/A
17th	0,066	0,034	0,149	0,075	N/A	N/A
18th	0,004	0,002	0,005	0,003	N/A	N/A
19th	0,042	0,021	0,117	0,060	N/A	N/A
20th	0,014	0,007	0,026	0,013	N/A	N/A
21th	0,004	0,002	0,006	0,003	N/A	N/A
22th	0,011	0,006	0,025	0,013	N/A	N/A
23th	0,015	0,008	0,066	0,034	N/A	N/A
24th	0,002	0,001	0,003	0,002	N/A	N/A
25th	0,007	0,004	0,050	0,025	N/A	N/A
26th	0,008	0,004	0,020	0,010	N/A	N/A
27th	0,004	0,002	0,007	0,004	N/A	N/A
28th	0,005	0,002	0,017	0,009	N/A	N/A
29th	0,004	0,002	0,033	0,017	N/A	N/A
30th	0,003	0,001	0,003	0,002	N/A	N/A
31th	0,007	0,004	0,026	0,013	N/A	N/A
32th	0,004	0,002	0,014	0,007	N/A	N/A
33th	0,003	0,002	0,005	0,003	N/A	N/A
34th	0,003	0,002	0,013	0,006	N/A	N/A
35th	0,011	0,005	0,017	0,008	N/A	N/A
36th	0,003	0,002	0,002	0,001	N/A	N/A
37th	0,008	0,004	0,018	0,009	N/A	N/A
38th	0,004	0,002	0,011	0,006	N/A	N/A
39th	0,004	0,002	0,004	0,002	N/A	N/A
40th	0,004	0,002	0,011	0,006	N/A	N/A
THD ₄₀ [%]	-	0,294	-	0,330	23%	13%
PWHD [%]	-	0,196	-	0,505	23%	22%

Power Quality. Harmonics.

Phase 3						
Generating Unit rating per phase (rpp)			SUN-136K-G01P3-EU-AM8			
	At 45-55% of rated ouput 68,0 kW		100% of rated output 136,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,088	0,045	0,187	0,095	8%	8%
3rd	0,021	0,011	0,035	0,018	21,6%	N/A
4th	0,056	0,028	0,127	0,064	4%	4%
5th	0,079	0,040	0,087	0,044	10,7%	10,7%
6th	0,008	0,004	0,015	0,008	2,67%	2,67%
7th	0,047	0,024	0,057	0,029	7,2%	7,2%
8th	0,030	0,015	0,049	0,025	2%	2%
9th	0,006	0,003	0,014	0,007	3,8%	N/A
10th	0,029	0,015	0,047	0,024	1,6%	1,6%
11th	0,206	0,104	0,461	0,234	3,1%	3,1%
12th	0,006	0,003	0,009	0,005	1,33%	1,33%
13th	0,133	0,068	0,322	0,163	2%	2%
14th	0,029	0,015	0,046	0,023	N/A	N/A
15th	0,004	0,002	0,005	0,003	N/A	N/A
16th	0,019	0,010	0,031	0,016	N/A	N/A
17th	0,067	0,034	0,156	0,079	N/A	N/A
18th	0,003	0,002	0,004	0,002	N/A	N/A
19th	0,039	0,020	0,114	0,058	N/A	N/A
20th	0,016	0,008	0,026	0,013	N/A	N/A
21th	0,004	0,002	0,004	0,002	N/A	N/A
22th	0,010	0,005	0,022	0,011	N/A	N/A
23th	0,014	0,007	0,067	0,034	N/A	N/A
24th	0,003	0,001	0,003	0,001	N/A	N/A
25th	0,005	0,002	0,047	0,024	N/A	N/A
26th	0,007	0,003	0,018	0,009	N/A	N/A
27th	0,004	0,002	0,004	0,002	N/A	N/A
28th	0,004	0,002	0,015	0,008	N/A	N/A
29th	0,005	0,003	0,034	0,017	N/A	N/A
30th	0,003	0,001	0,002	0,001	N/A	N/A
31th	0,010	0,005	0,021	0,010	N/A	N/A
32th	0,005	0,002	0,013	0,006	N/A	N/A
33th	0,003	0,001	0,004	0,002	N/A	N/A
34th	0,002	0,001	0,012	0,006	N/A	N/A
35th	0,012	0,006	0,016	0,008	N/A	N/A
36th	0,003	0,001	0,002	0,001	N/A	N/A
37th	0,010	0,005	0,013	0,007	N/A	N/A
38th	0,005	0,003	0,010	0,005	N/A	N/A
39th	0,002	0,001	0,003	0,002	N/A	N/A
40th	0,003	0,001	0,011	0,005	N/A	N/A
THD ₄₀ [%]	-	0,305	-	0,336	23%	13%
PWHD [%]	-	0,199	-	0,504	23%	22%

Power Quality. Harmonics.						
Phase 1						
Generating Unit rating per phase (rpp)			SUN-135K-G01P3-EU-AM8			
	At 45-55% of rated ouput 67,5 kW		100% of rated output 135,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,058	0,030	0,133	0,068	8%	8%
3rd	0,023	0,012	0,031	0,016	21,6%	N/A
4th	0,058	0,030	0,121	0,062	4%	4%
5th	0,069	0,035	0,082	0,042	10,7%	10,7%
6th	0,005	0,003	0,008	0,004	2,67%	2,67%
7th	0,049	0,025	0,053	0,027	7,2%	7,2%
8th	0,031	0,016	0,042	0,022	2%	2%
9th	0,016	0,008	0,029	0,015	3,8%	N/A
10th	0,027	0,014	0,048	0,025	1,6%	1,6%
11th	0,196	0,100	0,439	0,224	3,1%	3,1%
12th	0,003	0,002	0,005	0,003	1,33%	1,33%
13th	0,136	0,069	0,327	0,167	2%	2%
14th	0,023	0,012	0,038	0,020	N/A	N/A
15th	0,004	0,002	0,010	0,005	N/A	N/A
16th	0,020	0,010	0,031	0,016	N/A	N/A
17th	0,064	0,033	0,151	0,077	N/A	N/A
18th	0,003	0,001	0,005	0,002	N/A	N/A
19th	0,043	0,022	0,120	0,061	N/A	N/A
20th	0,013	0,006	0,023	0,012	N/A	N/A
21th	0,004	0,002	0,007	0,003	N/A	N/A
22th	0,012	0,006	0,023	0,012	N/A	N/A
23th	0,013	0,007	0,064	0,033	N/A	N/A
24th	0,002	0,001	0,003	0,001	N/A	N/A
25th	0,006	0,003	0,050	0,026	N/A	N/A
26th	0,006	0,003	0,016	0,008	N/A	N/A
27th	0,003	0,002	0,005	0,002	N/A	N/A
28th	0,004	0,002	0,014	0,007	N/A	N/A
29th	0,005	0,003	0,030	0,015	N/A	N/A
30th	0,002	0,001	0,002	0,001	N/A	N/A
31th	0,010	0,005	0,024	0,012	N/A	N/A
32th	0,002	0,001	0,011	0,006	N/A	N/A
33th	0,003	0,001	0,004	0,002	N/A	N/A
34th	0,004	0,002	0,011	0,005	N/A	N/A
35th	0,012	0,006	0,013	0,007	N/A	N/A
36th	0,002	0,001	0,002	0,001	N/A	N/A
37th	0,010	0,005	0,018	0,009	N/A	N/A
38th	0,003	0,001	0,009	0,005	N/A	N/A
39th	0,003	0,002	0,003	0,002	N/A	N/A
40th	0,005	0,003	0,010	0,005	N/A	N/A
THD ₄₀ [%]	-	0,292	-	0,323	23%	13%
PWHD [%]	-	0,197	-	0,500	23%	22%

Power Quality. Harmonics.						
Phase 2						
Generating Unit rating per phase (rpp)			SUN-135K-G01P3-EU-AM8			
	At 45-55% of rated ouput 67,5 kW		100% of rated output 135,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,070	0,036	0,170	0,087	8%	8%
3rd	0,011	0,006	0,046	0,024	21,6%	N/A
4th	0,059	0,030	0,125	0,064	4%	4%
5th	0,070	0,036	0,085	0,043	10,7%	10,7%
6th	0,010	0,005	0,013	0,007	2,67%	2,67%
7th	0,055	0,028	0,078	0,040	7,2%	7,2%
8th	0,019	0,010	0,029	0,015	2%	2%
9th	0,009	0,005	0,016	0,008	3,8%	N/A
10th	0,031	0,016	0,053	0,027	1,6%	1,6%
11th	0,198	0,101	0,440	0,225	3,1%	3,1%
12th	0,006	0,003	0,010	0,005	1,33%	1,33%
13th	0,136	0,070	0,322	0,165	2%	2%
14th	0,023	0,012	0,044	0,022	N/A	N/A
15th	0,005	0,003	0,008	0,004	N/A	N/A
16th	0,019	0,010	0,032	0,016	N/A	N/A
17th	0,065	0,033	0,147	0,075	N/A	N/A
18th	0,004	0,002	0,005	0,003	N/A	N/A
19th	0,042	0,021	0,117	0,060	N/A	N/A
20th	0,014	0,007	0,026	0,013	N/A	N/A
21th	0,004	0,002	0,006	0,003	N/A	N/A
22th	0,011	0,006	0,025	0,013	N/A	N/A
23th	0,015	0,008	0,066	0,034	N/A	N/A
24th	0,002	0,001	0,004	0,002	N/A	N/A
25th	0,007	0,003	0,049	0,025	N/A	N/A
26th	0,008	0,004	0,020	0,010	N/A	N/A
27th	0,005	0,002	0,007	0,004	N/A	N/A
28th	0,005	0,002	0,017	0,009	N/A	N/A
29th	0,004	0,002	0,033	0,017	N/A	N/A
30th	0,003	0,001	0,003	0,002	N/A	N/A
31th	0,007	0,004	0,026	0,013	N/A	N/A
32th	0,004	0,002	0,014	0,007	N/A	N/A
33th	0,003	0,002	0,005	0,003	N/A	N/A
34th	0,003	0,002	0,013	0,006	N/A	N/A
35th	0,011	0,005	0,016	0,008	N/A	N/A
36th	0,003	0,002	0,003	0,001	N/A	N/A
37th	0,008	0,004	0,018	0,009	N/A	N/A
38th	0,004	0,002	0,011	0,006	N/A	N/A
39th	0,004	0,002	0,005	0,002	N/A	N/A
40th	0,004	0,002	0,011	0,006	N/A	N/A
THD ₄₀ [%]	-	0,295	-	0,328	23%	13%
PWHD [%]	-	0,196	-	0,502	23%	22%

Power Quality. Harmonics.						
Phase 3						
Generating Unit rating per phase (rpp)			SUN-135K-G01P3-EU-AM8			
	At 45-55% of rated ouput 67,5 kW		100% of rated output 135,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,091	0,046	0,188	0,096	8%	8%
3rd	0,025	0,013	0,045	0,023	21,6%	N/A
4th	0,057	0,029	0,123	0,063	4%	4%
5th	0,079	0,040	0,091	0,047	10,7%	10,7%
6th	0,008	0,004	0,014	0,007	2,67%	2,67%
7th	0,047	0,024	0,058	0,030	7,2%	7,2%
8th	0,031	0,016	0,049	0,025	2%	2%
9th	0,006	0,003	0,017	0,009	3,8%	N/A
10th	0,029	0,015	0,045	0,023	1,6%	1,6%
11th	0,204	0,105	0,453	0,232	3,1%	3,1%
12th	0,006	0,003	0,009	0,005	1,33%	1,33%
13th	0,131	0,067	0,318	0,162	2%	2%
14th	0,029	0,015	0,045	0,023	N/A	N/A
15th	0,005	0,002	0,006	0,003	N/A	N/A
16th	0,019	0,010	0,031	0,016	N/A	N/A
17th	0,066	0,034	0,154	0,079	N/A	N/A
18th	0,003	0,002	0,004	0,002	N/A	N/A
19th	0,038	0,019	0,113	0,058	N/A	N/A
20th	0,016	0,008	0,026	0,013	N/A	N/A
21th	0,004	0,002	0,004	0,002	N/A	N/A
22th	0,010	0,005	0,022	0,011	N/A	N/A
23th	0,013	0,007	0,066	0,034	N/A	N/A
24th	0,003	0,001	0,002	0,001	N/A	N/A
25th	0,004	0,002	0,046	0,023	N/A	N/A
26th	0,007	0,003	0,018	0,009	N/A	N/A
27th	0,004	0,002	0,004	0,002	N/A	N/A
28th	0,004	0,002	0,015	0,008	N/A	N/A
29th	0,006	0,003	0,033	0,017	N/A	N/A
30th	0,003	0,001	0,002	0,001	N/A	N/A
31th	0,011	0,005	0,020	0,010	N/A	N/A
32th	0,005	0,002	0,013	0,006	N/A	N/A
33th	0,003	0,001	0,004	0,002	N/A	N/A
34th	0,002	0,001	0,012	0,006	N/A	N/A
35th	0,012	0,006	0,016	0,008	N/A	N/A
36th	0,003	0,001	0,002	0,001	N/A	N/A
37th	0,010	0,005	0,013	0,007	N/A	N/A
38th	0,005	0,003	0,010	0,005	N/A	N/A
39th	0,002	0,001	0,004	0,002	N/A	N/A
40th	0,003	0,001	0,010	0,005	N/A	N/A
THD ₄₀ [%]	-	0,307	-	0,335	23%	13%
PWHD [%]	-	0,198	-	0,498	23%	22%

Power Quality. Harmonics.						
Phase 1						
Generating Unit rating per phase (rpp)			SUN-130K-G01P3-EU-AM8			
	At 45-55% of rated ouput 65,0 kW		100% of rated output 130,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,064	0,034	0,133	0,070	8%	8%
3rd	0,018	0,009	0,027	0,014	21,6%	N/A
4th	0,053	0,028	0,114	0,060	4%	4%
5th	0,068	0,036	0,085	0,045	10,7%	10,7%
6th	0,005	0,002	0,007	0,004	2,67%	2,67%
7th	0,049	0,026	0,050	0,027	7,2%	7,2%
8th	0,032	0,017	0,039	0,020	2%	2%
9th	0,016	0,008	0,027	0,014	3,8%	N/A
10th	0,026	0,014	0,046	0,024	1,6%	1,6%
11th	0,185	0,098	0,417	0,221	3,1%	3,1%
12th	0,004	0,002	0,004	0,002	1,33%	1,33%
13th	0,131	0,070	0,313	0,166	2%	2%
14th	0,023	0,012	0,038	0,020	N/A	N/A
15th	0,004	0,002	0,009	0,005	N/A	N/A
16th	0,019	0,010	0,031	0,016	N/A	N/A
17th	0,060	0,032	0,146	0,077	N/A	N/A
18th	0,003	0,001	0,004	0,002	N/A	N/A
19th	0,038	0,020	0,116	0,062	N/A	N/A
20th	0,012	0,006	0,023	0,012	N/A	N/A
21th	0,004	0,002	0,007	0,003	N/A	N/A
22th	0,011	0,006	0,022	0,012	N/A	N/A
23th	0,011	0,006	0,062	0,033	N/A	N/A
24th	0,003	0,001	0,003	0,001	N/A	N/A
25th	0,003	0,002	0,046	0,025	N/A	N/A
26th	0,005	0,003	0,016	0,009	N/A	N/A
27th	0,003	0,002	0,005	0,002	N/A	N/A
28th	0,003	0,002	0,014	0,007	N/A	N/A
29th	0,007	0,004	0,027	0,015	N/A	N/A
30th	0,002	0,001	0,002	0,001	N/A	N/A
31th	0,011	0,006	0,023	0,012	N/A	N/A
32th	0,002	0,001	0,011	0,006	N/A	N/A
33th	0,003	0,001	0,004	0,002	N/A	N/A
34th	0,003	0,002	0,010	0,006	N/A	N/A
35th	0,012	0,006	0,012	0,006	N/A	N/A
36th	0,002	0,001	0,002	0,001	N/A	N/A
37th	0,011	0,006	0,017	0,009	N/A	N/A
38th	0,003	0,001	0,010	0,005	N/A	N/A
39th	0,003	0,002	0,003	0,002	N/A	N/A
40th	0,005	0,003	0,009	0,005	N/A	N/A
THD ₄₀ [%]	-	0,290	-	0,320	23%	13%
PWHD [%]	-	0,191	-	0,504	23%	22%

Power Quality. Harmonics.						
Phase 2						
Generating Unit rating per phase (rpp)			SUN-130K-G01P3-EU-AM8			
	At 45-55% of rated ouput 65,0 kW		100% of rated output 130,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,067	0,036	0,158	0,084	8%	8%
3rd	0,008	0,004	0,038	0,020	21,6%	N/A
4th	0,054	0,029	0,117	0,062	4%	4%
5th	0,070	0,037	0,085	0,045	10,7%	10,7%
6th	0,008	0,004	0,011	0,006	2,67%	2,67%
7th	0,056	0,030	0,074	0,039	7,2%	7,2%
8th	0,019	0,010	0,026	0,014	2%	2%
9th	0,009	0,005	0,013	0,007	3,8%	N/A
10th	0,031	0,016	0,050	0,027	1,6%	1,6%
11th	0,187	0,099	0,417	0,221	3,1%	3,1%
12th	0,005	0,003	0,009	0,005	1,33%	1,33%
13th	0,132	0,070	0,309	0,164	2%	2%
14th	0,022	0,012	0,042	0,022	N/A	N/A
15th	0,005	0,003	0,008	0,004	N/A	N/A
16th	0,018	0,010	0,031	0,016	N/A	N/A
17th	0,060	0,032	0,142	0,075	N/A	N/A
18th	0,004	0,002	0,005	0,003	N/A	N/A
19th	0,037	0,020	0,113	0,060	N/A	N/A
20th	0,014	0,007	0,026	0,014	N/A	N/A
21th	0,004	0,002	0,006	0,003	N/A	N/A
22th	0,010	0,005	0,023	0,012	N/A	N/A
23th	0,012	0,006	0,064	0,034	N/A	N/A
24th	0,002	0,001	0,003	0,002	N/A	N/A
25th	0,004	0,002	0,046	0,024	N/A	N/A
26th	0,007	0,004	0,019	0,010	N/A	N/A
27th	0,004	0,002	0,007	0,003	N/A	N/A
28th	0,004	0,002	0,016	0,008	N/A	N/A
29th	0,006	0,003	0,030	0,016	N/A	N/A
30th	0,003	0,001	0,003	0,002	N/A	N/A
31th	0,009	0,005	0,024	0,013	N/A	N/A
32th	0,004	0,002	0,013	0,007	N/A	N/A
33th	0,003	0,002	0,005	0,003	N/A	N/A
34th	0,003	0,002	0,012	0,007	N/A	N/A
35th	0,011	0,006	0,015	0,008	N/A	N/A
36th	0,003	0,002	0,002	0,001	N/A	N/A
37th	0,008	0,004	0,017	0,009	N/A	N/A
38th	0,004	0,002	0,011	0,006	N/A	N/A
39th	0,003	0,002	0,005	0,002	N/A	N/A
40th	0,003	0,002	0,010	0,006	N/A	N/A
THD ₄₀ [%]	-	0,292	-	0,323	23%	13%
PWHD [%]	-	0,188	-	0,504	23%	22%

Power Quality. Harmonics.						
Phase 3						
Generating Unit rating per phase (rpp)			SUN-130K-G01P3-EU-AM8			
	At 45-55% of rated ouput 65,0 kW		100% of rated output 130,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,084	0,045	0,175	0,093	8%	8%
3rd	0,021	0,011	0,042	0,022	21,6%	N/A
4th	0,053	0,028	0,116	0,062	4%	4%
5th	0,079	0,042	0,092	0,049	10,7%	10,7%
6th	0,007	0,004	0,011	0,006	2,67%	2,67%
7th	0,047	0,025	0,057	0,030	7,2%	7,2%
8th	0,031	0,016	0,046	0,024	2%	2%
9th	0,006	0,003	0,015	0,008	3,8%	N/A
10th	0,028	0,015	0,044	0,024	1,6%	1,6%
11th	0,193	0,103	0,432	0,229	3,1%	3,1%
12th	0,006	0,003	0,008	0,004	1,33%	1,33%
13th	0,127	0,067	0,304	0,161	2%	2%
14th	0,027	0,014	0,045	0,024	N/A	N/A
15th	0,004	0,002	0,005	0,003	N/A	N/A
16th	0,018	0,010	0,030	0,016	N/A	N/A
17th	0,060	0,032	0,150	0,079	N/A	N/A
18th	0,003	0,002	0,003	0,002	N/A	N/A
19th	0,034	0,018	0,109	0,058	N/A	N/A
20th	0,015	0,008	0,026	0,014	N/A	N/A
21th	0,004	0,002	0,004	0,002	N/A	N/A
22th	0,010	0,005	0,021	0,011	N/A	N/A
23th	0,010	0,005	0,064	0,034	N/A	N/A
24th	0,003	0,002	0,002	0,001	N/A	N/A
25th	0,003	0,001	0,042	0,022	N/A	N/A
26th	0,006	0,003	0,018	0,009	N/A	N/A
27th	0,004	0,002	0,004	0,002	N/A	N/A
28th	0,003	0,002	0,014	0,008	N/A	N/A
29th	0,008	0,004	0,031	0,016	N/A	N/A
30th	0,003	0,001	0,002	0,001	N/A	N/A
31th	0,012	0,006	0,019	0,010	N/A	N/A
32th	0,004	0,002	0,012	0,006	N/A	N/A
33th	0,003	0,001	0,004	0,002	N/A	N/A
34th	0,002	0,001	0,011	0,006	N/A	N/A
35th	0,013	0,007	0,014	0,007	N/A	N/A
36th	0,003	0,002	0,002	0,001	N/A	N/A
37th	0,010	0,006	0,012	0,006	N/A	N/A
38th	0,005	0,003	0,010	0,005	N/A	N/A
39th	0,002	0,001	0,004	0,002	N/A	N/A
40th	0,003	0,002	0,010	0,005	N/A	N/A
THD ₄₀ [%]	-	0,303	-	0,332	23%	13%
PWHD [%]	-	0,191	-	0,503	23%	22%

Power Quality. Harmonics.						
Phase 1						
Generating Unit rating per phase (rpp)			SUN-125K-G01P3-EU-AM8			
	At 45-55% of rated ouput 62,5 kW		100% of rated output 125,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,063	0,033	0,121	0,064	8%	8%
3rd	0,019	0,010	0,034	0,018	21,6%	N/A
4th	0,051	0,027	0,107	0,057	4%	4%
5th	0,067	0,036	0,086	0,046	10,7%	10,7%
6th	0,005	0,003	0,007	0,004	2,67%	2,67%
7th	0,049	0,026	0,047	0,025	7,2%	7,2%
8th	0,033	0,017	0,038	0,020	2%	2%
9th	0,015	0,008	0,027	0,015	3,8%	N/A
10th	0,026	0,014	0,043	0,023	1,6%	1,6%
11th	0,176	0,094	0,395	0,210	3,1%	3,1%
12th	0,004	0,002	0,005	0,002	1,33%	1,33%
13th	0,125	0,067	0,301	0,160	2%	2%
14th	0,022	0,012	0,036	0,019	N/A	N/A
15th	0,004	0,002	0,009	0,005	N/A	N/A
16th	0,019	0,010	0,030	0,016	N/A	N/A
17th	0,055	0,029	0,142	0,076	N/A	N/A
18th	0,003	0,001	0,004	0,002	N/A	N/A
19th	0,034	0,018	0,111	0,059	N/A	N/A
20th	0,012	0,006	0,022	0,012	N/A	N/A
21th	0,004	0,002	0,006	0,003	N/A	N/A
22th	0,010	0,006	0,022	0,011	N/A	N/A
23th	0,008	0,004	0,060	0,032	N/A	N/A
24th	0,002	0,001	0,002	0,001	N/A	N/A
25th	0,002	0,001	0,043	0,023	N/A	N/A
26th	0,004	0,002	0,015	0,008	N/A	N/A
27th	0,003	0,002	0,005	0,002	N/A	N/A
28th	0,003	0,001	0,013	0,007	N/A	N/A
29th	0,009	0,005	0,025	0,013	N/A	N/A
30th	0,002	0,001	0,002	0,001	N/A	N/A
31th	0,013	0,007	0,021	0,011	N/A	N/A
32th	0,002	0,001	0,010	0,005	N/A	N/A
33th	0,003	0,001	0,004	0,002	N/A	N/A
34th	0,004	0,002	0,010	0,005	N/A	N/A
35th	0,013	0,007	0,011	0,006	N/A	N/A
36th	0,002	0,001	0,002	0,001	N/A	N/A
37th	0,011	0,006	0,015	0,008	N/A	N/A
38th	0,003	0,002	0,009	0,005	N/A	N/A
39th	0,003	0,001	0,003	0,002	N/A	N/A
40th	0,005	0,003	0,009	0,005	N/A	N/A
THD ₄₀ [%]	-	0,289	-	0,318	23%	13%
PWHD [%]	-	0,187	-	0,503	23%	22%

Power Quality. Harmonics.						
Phase 2						
Generating Unit rating per phase (rpp)			SUN-125K-G01P3-EU-AM8			
	At 45-55% of rated ouput 62,5 kW		100% of rated output 125,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,066	0,035	0,154	0,082	8%	8%
3rd	0,009	0,005	0,042	0,022	21,6%	N/A
4th	0,053	0,028	0,111	0,059	4%	4%
5th	0,070	0,037	0,088	0,047	10,7%	10,7%
6th	0,008	0,004	0,014	0,007	2,67%	2,67%
7th	0,056	0,030	0,068	0,036	7,2%	7,2%
8th	0,020	0,010	0,025	0,013	2%	2%
9th	0,010	0,005	0,014	0,007	3,8%	N/A
10th	0,031	0,016	0,047	0,025	1,6%	1,6%
11th	0,178	0,095	0,395	0,210	3,1%	3,1%
12th	0,005	0,003	0,009	0,005	1,33%	1,33%
13th	0,126	0,067	0,297	0,158	2%	2%
14th	0,022	0,012	0,040	0,021	N/A	N/A
15th	0,005	0,003	0,007	0,004	N/A	N/A
16th	0,017	0,009	0,031	0,016	N/A	N/A
17th	0,056	0,030	0,139	0,074	N/A	N/A
18th	0,004	0,002	0,005	0,002	N/A	N/A
19th	0,033	0,018	0,108	0,057	N/A	N/A
20th	0,013	0,007	0,025	0,013	N/A	N/A
21th	0,004	0,002	0,006	0,003	N/A	N/A
22th	0,009	0,005	0,023	0,012	N/A	N/A
23th	0,009	0,005	0,061	0,032	N/A	N/A
24th	0,002	0,001	0,003	0,002	N/A	N/A
25th	0,002	0,001	0,042	0,022	N/A	N/A
26th	0,006	0,003	0,018	0,010	N/A	N/A
27th	0,004	0,002	0,006	0,003	N/A	N/A
28th	0,003	0,002	0,015	0,008	N/A	N/A
29th	0,009	0,005	0,028	0,015	N/A	N/A
30th	0,003	0,002	0,003	0,002	N/A	N/A
31th	0,011	0,006	0,023	0,012	N/A	N/A
32th	0,003	0,002	0,013	0,007	N/A	N/A
33th	0,003	0,002	0,005	0,003	N/A	N/A
34th	0,002	0,001	0,012	0,006	N/A	N/A
35th	0,012	0,006	0,013	0,007	N/A	N/A
36th	0,003	0,002	0,003	0,001	N/A	N/A
37th	0,009	0,005	0,015	0,008	N/A	N/A
38th	0,004	0,002	0,010	0,006	N/A	N/A
39th	0,003	0,002	0,004	0,002	N/A	N/A
40th	0,003	0,002	0,010	0,005	N/A	N/A
THD ₄₀ [%]	-	0,292	-	0,322	23%	13%
PWHD [%]	-	0,185	-	0,504	23%	22%

Power Quality. Harmonics.						
Phase 3						
Generating Unit rating per phase (rpp)			SUN-125K-G01P3-EU-AM8			
	At 45-55% of rated ouput 62,5 kW		100% of rated output 125,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,084	0,045	0,173	0,092	8%	8%
3rd	0,022	0,012	0,045	0,024	21,6%	N/A
4th	0,050	0,027	0,112	0,059	4%	4%
5th	0,080	0,042	0,097	0,052	10,7%	10,7%
6th	0,008	0,004	0,013	0,007	2,67%	2,67%
7th	0,047	0,025	0,053	0,028	7,2%	7,2%
8th	0,031	0,017	0,045	0,024	2%	2%
9th	0,005	0,003	0,015	0,008	3,8%	N/A
10th	0,028	0,015	0,041	0,022	1,6%	1,6%
11th	0,184	0,098	0,408	0,217	3,1%	3,1%
12th	0,006	0,003	0,008	0,004	1,33%	1,33%
13th	0,120	0,064	0,292	0,155	2%	2%
14th	0,027	0,014	0,043	0,023	N/A	N/A
15th	0,005	0,002	0,005	0,003	N/A	N/A
16th	0,018	0,010	0,030	0,016	N/A	N/A
17th	0,055	0,029	0,146	0,078	N/A	N/A
18th	0,003	0,002	0,003	0,002	N/A	N/A
19th	0,030	0,016	0,103	0,055	N/A	N/A
20th	0,014	0,007	0,025	0,013	N/A	N/A
21th	0,004	0,002	0,004	0,002	N/A	N/A
22th	0,009	0,005	0,020	0,011	N/A	N/A
23th	0,007	0,004	0,061	0,033	N/A	N/A
24th	0,003	0,002	0,002	0,001	N/A	N/A
25th	0,002	0,001	0,039	0,021	N/A	N/A
26th	0,005	0,003	0,017	0,009	N/A	N/A
27th	0,004	0,002	0,004	0,002	N/A	N/A
28th	0,003	0,001	0,014	0,007	N/A	N/A
29th	0,010	0,005	0,028	0,015	N/A	N/A
30th	0,003	0,002	0,002	0,001	N/A	N/A
31th	0,013	0,007	0,018	0,009	N/A	N/A
32th	0,004	0,002	0,012	0,006	N/A	N/A
33th	0,003	0,001	0,004	0,002	N/A	N/A
34th	0,003	0,001	0,011	0,006	N/A	N/A
35th	0,014	0,007	0,013	0,007	N/A	N/A
36th	0,003	0,002	0,002	0,001	N/A	N/A
37th	0,011	0,006	0,010	0,005	N/A	N/A
38th	0,005	0,003	0,010	0,005	N/A	N/A
39th	0,002	0,001	0,003	0,002	N/A	N/A
40th	0,004	0,002	0,009	0,005	N/A	N/A
THD ₄₀ [%]	-	0,303	-	0,331	23%	13%
PWHD [%]	-	0,188	-	0,501	23%	22%

Power Quality. Harmonics.

Phase 1						
Generating Unit rating per phase (rpp)			SUN-120K-G01P3-EU-AM8			
	At 45-55% of rated ouput 60,0 kW		100% of rated output 120,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,064	0,037	0,116	0,067	8%	8%
3rd	0,015	0,009	0,026	0,015	21,6%	N/A
4th	0,049	0,028	0,101	0,058	4%	4%
5th	0,067	0,039	0,088	0,050	10,7%	10,7%
6th	0,004	0,002	0,006	0,004	2,67%	2,67%
7th	0,049	0,028	0,046	0,026	7,2%	7,2%
8th	0,033	0,019	0,035	0,020	2%	2%
9th	0,014	0,008	0,025	0,014	3,8%	N/A
10th	0,026	0,015	0,041	0,023	1,6%	1,6%
11th	0,167	0,096	0,374	0,215	3,1%	3,1%
12th	0,004	0,002	0,004	0,002	1,33%	1,33%
13th	0,118	0,068	0,288	0,166	2%	2%
14th	0,021	0,012	0,035	0,020	N/A	N/A
15th	0,004	0,002	0,008	0,005	N/A	N/A
16th	0,019	0,011	0,029	0,017	N/A	N/A
17th	0,050	0,029	0,139	0,080	N/A	N/A
18th	0,003	0,002	0,004	0,002	N/A	N/A
19th	0,030	0,017	0,105	0,061	N/A	N/A
20th	0,011	0,006	0,021	0,012	N/A	N/A
21th	0,004	0,002	0,006	0,003	N/A	N/A
22th	0,009	0,005	0,021	0,012	N/A	N/A
23th	0,005	0,003	0,056	0,032	N/A	N/A
24th	0,003	0,001	0,003	0,001	N/A	N/A
25th	0,003	0,002	0,041	0,024	N/A	N/A
26th	0,003	0,002	0,015	0,009	N/A	N/A
27th	0,003	0,002	0,004	0,003	N/A	N/A
28th	0,002	0,001	0,012	0,007	N/A	N/A
29th	0,011	0,006	0,023	0,013	N/A	N/A
30th	0,002	0,001	0,002	0,001	N/A	N/A
31th	0,014	0,008	0,019	0,011	N/A	N/A
32th	0,002	0,001	0,010	0,006	N/A	N/A
33th	0,003	0,002	0,004	0,002	N/A	N/A
34th	0,004	0,002	0,009	0,005	N/A	N/A
35th	0,014	0,008	0,009	0,005	N/A	N/A
36th	0,002	0,001	0,002	0,001	N/A	N/A
37th	0,011	0,006	0,014	0,008	N/A	N/A
38th	0,003	0,002	0,008	0,005	N/A	N/A
39th	0,002	0,001	0,003	0,002	N/A	N/A
40th	0,005	0,003	0,009	0,005	N/A	N/A
THD ₄₀ [%]	-	0,287	-	0,315	23%	13%
PWHD [%]	-	0,183	-	0,502	23%	22%

Power Quality. Harmonics.						
Phase 2						
Generating Unit rating per phase (rpp)			SUN-120K-G01P3-EU-AM8			
	At 45-55% of rated ouput 60,0 kW		100% of rated output 120,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,064	0,037	0,143	0,082	8%	8%
3rd	0,008	0,004	0,033	0,019	21,6%	N/A
4th	0,051	0,029	0,103	0,059	4%	4%
5th	0,071	0,041	0,089	0,051	10,7%	10,7%
6th	0,008	0,005	0,013	0,007	2,67%	2,67%
7th	0,055	0,032	0,065	0,037	7,2%	7,2%
8th	0,020	0,011	0,023	0,013	2%	2%
9th	0,009	0,005	0,012	0,007	3,8%	N/A
10th	0,031	0,018	0,045	0,026	1,6%	1,6%
11th	0,168	0,097	0,374	0,215	3,1%	3,1%
12th	0,005	0,003	0,009	0,005	1,33%	1,33%
13th	0,119	0,069	0,285	0,164	2%	2%
14th	0,021	0,012	0,039	0,022	N/A	N/A
15th	0,005	0,003	0,007	0,004	N/A	N/A
16th	0,016	0,009	0,029	0,017	N/A	N/A
17th	0,051	0,029	0,136	0,078	N/A	N/A
18th	0,004	0,002	0,005	0,003	N/A	N/A
19th	0,029	0,017	0,103	0,059	N/A	N/A
20th	0,012	0,007	0,024	0,014	N/A	N/A
21th	0,004	0,002	0,005	0,003	N/A	N/A
22th	0,008	0,005	0,022	0,012	N/A	N/A
23th	0,006	0,003	0,057	0,033	N/A	N/A
24th	0,002	0,001	0,003	0,002	N/A	N/A
25th	0,002	0,001	0,041	0,023	N/A	N/A
26th	0,005	0,003	0,018	0,010	N/A	N/A
27th	0,004	0,002	0,006	0,003	N/A	N/A
28th	0,003	0,002	0,014	0,008	N/A	N/A
29th	0,011	0,006	0,026	0,015	N/A	N/A
30th	0,003	0,002	0,003	0,002	N/A	N/A
31th	0,012	0,007	0,021	0,012	N/A	N/A
32th	0,002	0,001	0,012	0,007	N/A	N/A
33th	0,003	0,002	0,005	0,003	N/A	N/A
34th	0,002	0,001	0,011	0,006	N/A	N/A
35th	0,013	0,007	0,012	0,007	N/A	N/A
36th	0,003	0,002	0,002	0,001	N/A	N/A
37th	0,009	0,005	0,013	0,008	N/A	N/A
38th	0,004	0,002	0,009	0,005	N/A	N/A
39th	0,003	0,001	0,004	0,002	N/A	N/A
40th	0,003	0,002	0,010	0,006	N/A	N/A
THD ₄₀ [%]	-	0,290	-	0,318	23%	13%
PWHD [%]	-	0,180	-	0,504	23%	22%

Power Quality. Harmonics.						
Phase 3						
Generating Unit rating per phase (rpp)			SUN-120K-G01P3-EU-AM8			
	At 45-55% of rated ouput 60,0 kW		100% of rated output 120,0 kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Limit in BS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,079	0,045	0,165	0,095	8%	8%
3rd	0,018	0,010	0,038	0,022	21,6%	N/A
4th	0,049	0,028	0,103	0,059	4%	4%
5th	0,079	0,046	0,096	0,055	10,7%	10,7%
6th	0,007	0,004	0,012	0,007	2,67%	2,67%
7th	0,046	0,026	0,050	0,029	7,2%	7,2%
8th	0,031	0,018	0,040	0,023	2%	2%
9th	0,005	0,003	0,014	0,008	3,8%	N/A
10th	0,027	0,015	0,041	0,023	1,6%	1,6%
11th	0,174	0,100	0,388	0,223	3,1%	3,1%
12th	0,006	0,004	0,008	0,005	1,33%	1,33%
13th	0,113	0,065	0,279	0,161	2%	2%
14th	0,025	0,015	0,042	0,024	N/A	N/A
15th	0,005	0,003	0,005	0,003	N/A	N/A
16th	0,017	0,010	0,029	0,017	N/A	N/A
17th	0,050	0,029	0,143	0,082	N/A	N/A
18th	0,003	0,002	0,003	0,002	N/A	N/A
19th	0,026	0,015	0,097	0,056	N/A	N/A
20th	0,013	0,007	0,025	0,014	N/A	N/A
21th	0,004	0,002	0,004	0,002	N/A	N/A
22th	0,008	0,005	0,019	0,011	N/A	N/A
23th	0,003	0,002	0,058	0,033	N/A	N/A
24th	0,003	0,002	0,002	0,001	N/A	N/A
25th	0,004	0,002	0,037	0,021	N/A	N/A
26th	0,004	0,002	0,016	0,009	N/A	N/A
27th	0,004	0,002	0,004	0,002	N/A	N/A
28th	0,002	0,001	0,013	0,007	N/A	N/A
29th	0,012	0,007	0,026	0,015	N/A	N/A
30th	0,003	0,002	0,002	0,001	N/A	N/A
31th	0,014	0,008	0,016	0,009	N/A	N/A
32th	0,003	0,002	0,011	0,006	N/A	N/A
33th	0,003	0,001	0,004	0,002	N/A	N/A
34th	0,003	0,002	0,010	0,006	N/A	N/A
35th	0,014	0,008	0,012	0,007	N/A	N/A
36th	0,003	0,002	0,002	0,001	N/A	N/A
37th	0,010	0,006	0,009	0,005	N/A	N/A
38th	0,005	0,003	0,009	0,005	N/A	N/A
39th	0,002	0,001	0,003	0,002	N/A	N/A
40th	0,004	0,002	0,009	0,005	N/A	N/A
THD ₄₀ [%]	-	0,300	-	0,327	23%	13%
PWHD [%]	-	0,182	-	0,501	23%	22%

Power Quality. Power factor.

Output power	216,2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within $\pm 1,5\%$ of the stated level during the test.
20%	0,9994	0,9992	0,9987	
50%	0,9994	0,9994	0,9994	
75%	0,9994	0,9993	0,9994	
100%	0,9993	0,9993	0,9993	
Limit leading	>0,95	>0,95	>0,95	

Power Quality. Voltage fluctuation and Flicker.

	Starting			Stopping			Running	
	dmax	dc	d(t)	dmax	dc	d(t)	Pst	Plt 2 hours
Measured values at test impedance	0,526	0,017	0,00	0,525	0,016	0,00	0,076	0,074
Measured values at standard impedance	0,526	0,017	0,00	0,525	0,016	0,00	0,076	0,074
Values for maximum impedance	0,526	0,017	0,00	0,525	0,016	0,00	0,076	0,074
Limits set under BS EN 61000-3-11	4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65
Test impedance	R	0,24	Ω		XI	0,15	Ω	
	Z	0,28	Ω					
Standard impedance	R	0,24	Ω		XI	0,15	Ω	
	Z	0,28	Ω					
Maximum impedance	R	0,24	Ω		XI	0,15*	Ω	
	Zmax	0,28	Ω					

Power Quality. DC injection.			
Phase 1			
Test level power [%]	10	55	100
Recorded value [mA]	0,088	0,173	0,266
Recorded value [%]	0,04	0,09	0,13
Limit [%]	0,25	0,25	0,25
Phase 2			
Test level power [%]	10	55	100
Recorded value [mA]	0,061	0,134	0,106
Recorded value [%]	0,03	0,07	0,05
Limit [%]	0,25	0,25	0,25
Phase 3			
Test level power [%]	10	55	100
Recorded value [mA]	0,068	0,196	0,239
Recorded value [%]	0,03	0,10	0,12
Limit [%]	0,25	0,25	0,25
Note. Informative measurement of DC-injection of each phase of the inverter and a limit of 0,25% per phase of the rated current per phase as pass criteria.			
Sum of all Phases Tests are carried out at three defined power levels $\pm 5\%$. At 230 V a 136,0 kW three phase Inverter has a current output of 591,30 A so DC limit is 1,48 A. These tests is undertaken in accordance with Annex A.7.1.4.4. The % DC injection ("as % of rated AC current" below) is calculated as follows: $\% \text{ DC injection} = \text{Recorded DC value in Amps} / \text{Base current where the base current is the Registered Capacity (W) / V phase.}$ The % DC injection should not be greater than 0,25%.			
Sum of all Phases			
Test level power [%]	10	55	100
Recorded value [mA]	0,217	0,503	0,611
Recorded value [%]	0,04	0,09	0,10
Limit [%]	0,25	0,25	0,25

Fault level Contribution.

For a directly coupled SSEG			For a Inverter SSEG		
Parameter	Symbol	Value	Time after fault	Volts [V]	Amps [A]
Peak Short Circuit current	I_p	N/A	20ms	65,35V	0,98A
Initial Value of aperiodic current	A	N/A	100ms	60,48V	0,66A
Initial symmetrical short-circuit current*	I_k	N/A	250ms	15,37V	0,51A
Decaying (aperiodic) component of short circuit current*	i_{dc}	N/A	500ms	4,16V	0,82A
Reactance/Resistance Ratio of source*	X/R	N/A	Time to Trip [s]	0,038s	

For rotating machines and linear piston machines the test should produce a 0s – 2s plot of the short circuit current as seen at the Generating Unit terminals.

* Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot.

Self Monitoring – Solid state switching.

It has been verified that in the event of the solid state switching device failing to disconnect the Power Park Module, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0,5 seconds.

Note. Unit do not provide solid state switching relays. In case the semiconductor bridge is switched off, then the voltage on the output drops to 0. In this case the relays on the output will also open (Functional safety of the internal automatic disconnection device according to VDE 0126-1-1 / VDE 0124-100).

Wiring functional tests if required by para. 15.2.1

Confirm that the relevant test schedule is attached (tests to be undertaken at time of commissioning).

Note.

The inverter was tested in a test laboratory. The correct wiring functional test in the field has to be done by the responsible person for the installation of the plant.

Logic Interface (input port) Required by paragraph 11.1.3.1

Confirm that an input port is provided and can be used to reduce the Active Power output to zero

Note. Manufacturer information provided.

Provide high level description of logic interface, e.g. details in 11.1.3.1 such as AC or DC signal

Note. The inverter has a DRM logical port, A 15K resistor needs to be connected to PIN 5 of the DRM port. The connection between PIN 1 and PIN 6 can be controlled by a switch. When the switch is closed, the inverter will reduce the active power to 0 within 5 seconds.

